

Known Biologically Important Areas for Cetaceans Chukchi Sea and Alaskan Beaufort Sea

The information compiled here represents work done by Janet Clarke of Science Applications International Corporation, with review and revisions contributed by the Cetacean Mapping Working Group members. Information presented was compiled from peer reviewed literature, National Marine Fisheries Service (NMFS) Stock Assessment Reports, and expert knowledge.

Disclaimer

This information pertains to known areas of feeding, calves, migratory corridors, resident populations or small populations of arctic cetaceans in U.S. EEZ waters, based on data collected from visual surveys, passive acoustic recordings, genetics and satellite tags. All arctic cetaceans can be found seasonally outside the U.S. EEZ (e.g., bowhead, gray and humpback whales and belugas in the northwestern Chukchi Sea in summer and fall, bowhead whales feeding in the Canadian Beaufort Sea in summer, etc.), and lack of inclusion here should not be interpreted as lack of occurrence, or lack of Important Areas, outside the U.S. EEZ.

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***Balaena mysticetus* (Bowhead Whale)**

Important Area (s) identified: feeding, cow-calf, migratory corridor

General

One bowhead whale stock is found in summer and fall in the northeastern Chukchi Sea and Alaskan Beaufort Sea, the Bering-Chukchi-Beaufort (BCB) or Western Arctic stock. In fall 2010, a satellite-tagged bowhead whale from the BCB stock overlapped temporally and spatially with a satellite-tagged bowhead whale from the Baffin Bay-Davis Strait stock in Viscount Melville Sound in the Northwest Passage of the Canadian Arctic, before each whale returned to their normal seasonal range. With the drastic loss of arctic sea ice since 2007, it is possible that these bowhead whale stocks may overlap seasonally more often. For the present time, however, the information presented below is assumed to represent the BCB stock only. Reference: Heide-Jorgensen et al., 2011.

Feeding

Monthly bowhead whale feeding area polygons for summer and fall (Figure 1) were derived primarily from data collected during the Aerial Surveys of Arctic Marine Mammals (ASAMM) project, and its precursors, BWASP (Bowhead Whale Aerial Survey Project) and COMIDA (Chukchi Offshore Monitoring in Drilling Area marine mammal aerial surveys). This study, funded by BOEM (formerly MMS), started in the late 1970s, with more systematic collection of data since 1982. Feeding behavior is likely underrepresented in this database due to the difficulty of identifying this behavior in the brief periods of time whales are observed during transect surveys. Some indications of feeding can be easily observed during initial sightings, including open mouth at the surface, mud on the rostrum, and echelon swimming. Other behaviors that might be indicative of feeding, including synchronous diving, flukes-up diving and defecation, may not be apparent unless further investigation of the sighting is initiated. The practice of diverting from transect to investigate sightings is not standardized, and is dependent on several factors including weather, visibility, and remaining fuel reserves. Also, the emphasis on recording feeding behavior into the database has varied greatly during the course of three decades of data collection. Additional information on bowhead whale feeding in the eastern Alaskan Beaufort Sea was available from an analysis of several studies, including localized industry-sponsored studies and MMS-sponsored feeding studies that took place in the 1980s. References: Landino et al., 1994; Richardson and Thomson, 2002; Clarke et al., 2010a, 2010 b, 2011a, 2011b.

Information on localized bowhead whale feeding in late summer and early fall was available from the Study of Northern Alaska Coastal System (SNACS) program, funded by NSF, and the Bowhead Whale Feeding Ecology Study (BOWFEST), funded by BOEM and MMS. These studies focused on the area between Pt. Barrow and Smith Bay, Alaska, and were largely conducted from late August through mid-September. References: Goetz et al., 2008, 2009, 2010, 2011; Moore et al., 2010.

Information on bowhead whale feeding in May was available from an analysis of bowhead whale photographs taken in 1985, 1986, 2003 and 2004. Bowhead whales photographed with mud visible on the dorsal surface were considered feeding under the assumption that the whales were feeding near the seafloor. References: Mocklin, 2009.

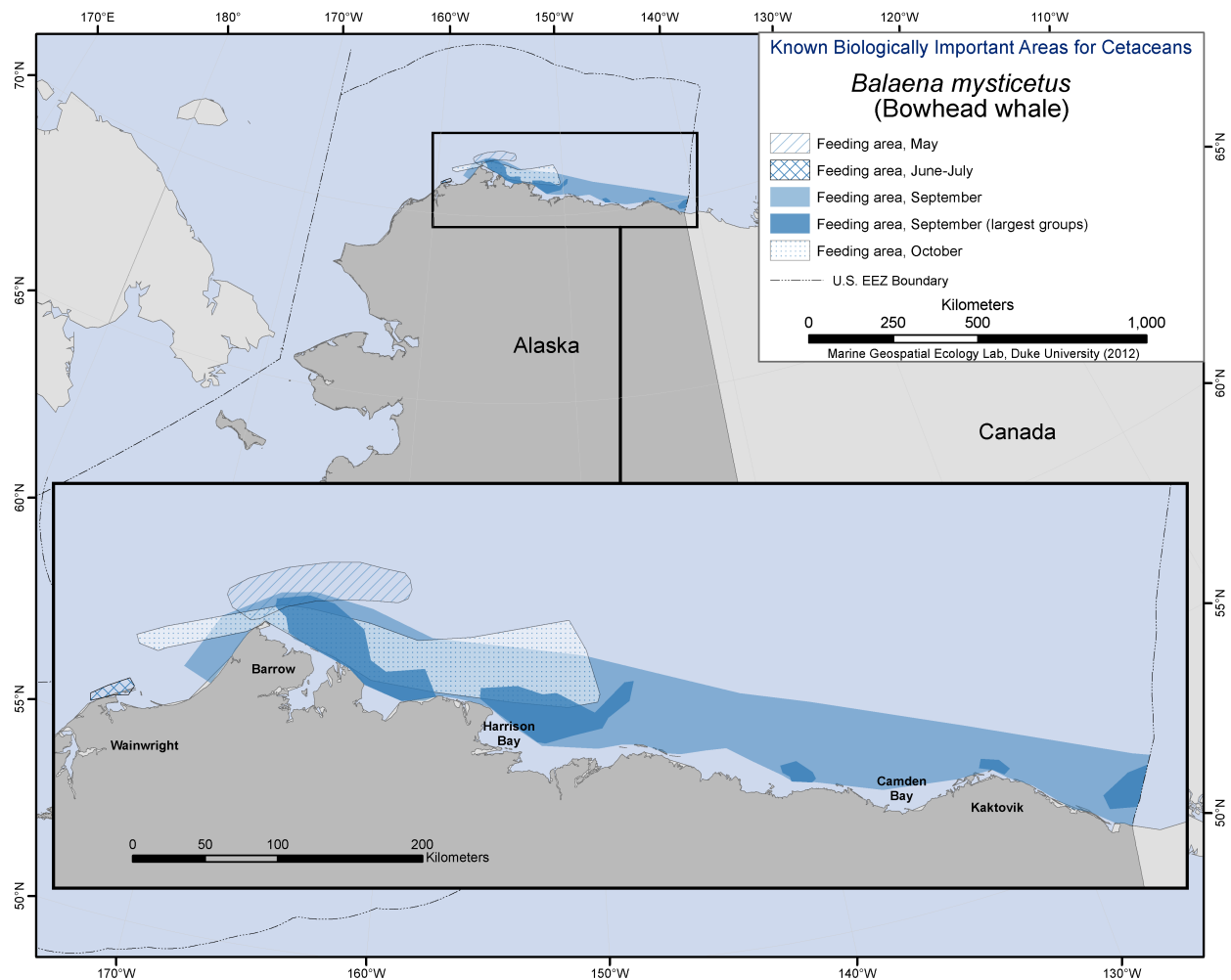


Figure 1: Bowhead whale feeding areas

In Figure 1, the solid darkest blue polygons represent areas where bowhead whale groups of >6 animals were most frequently seen. None of the feeding Important Areas extend inside the barrier islands, nor do they extend further south into Harrison or Camden Bays than what is shown here.

Reproduction

The bowhead whale cow-calf polygon for May (Figure 2) was based on data collected during photo-recapture aerial surveys conducted by the North Slope Borough and the National Marine Fisheries Service in spring 2011. The surveys focused specifically on the leads in the ice north and northeast of Pt. Barrow, and were designed to collect bowhead whale photographs for use in estimating BCB bowhead whale abundance. Surveys started on 19 April, but the first cow-calf pair was not photographed until 9 May. Segregation of size classes during the spring bowhead whale migration near Pt. Barrow has been previously noted, with cow-calf pairs generally later migrants. References: Zeh et al., 1993; Mocklin et al., 2012.

Bowhead whale cow-calf polygons for August, September and October (Figure 2) were plotted from data collected during the ASAMM project, and its precursors, BWASP and COMIDA, from 1982-2011. Because the study encompasses such a large geographic area and because the entire area was surveyed somewhat equivalently each year, these data likely are a better overall representation

bowhead whale calf distribution than other more localized studies (e.g., industry sponsored monitoring). References: Clarke et al., 1987, 2010a, 2011b.

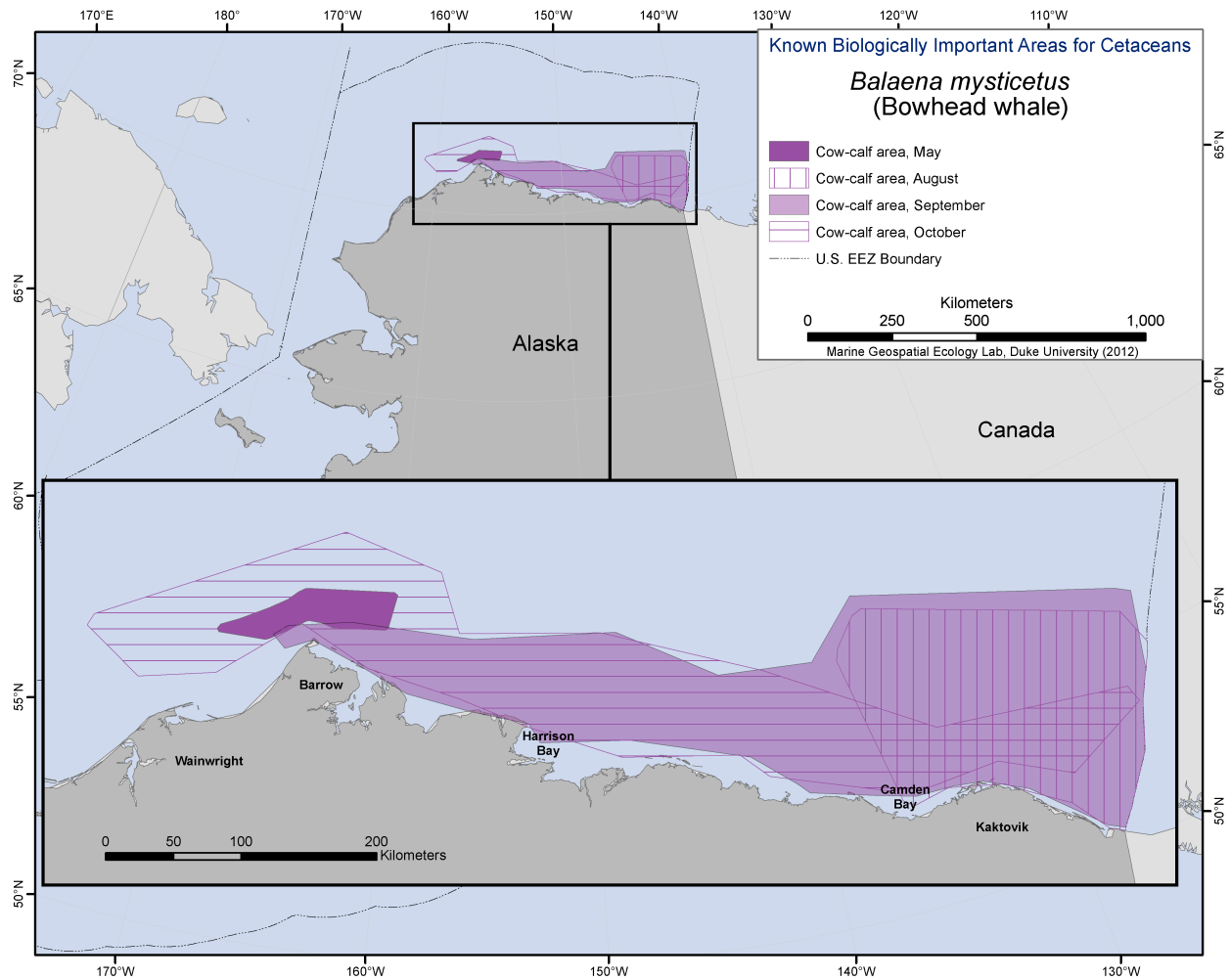


Figure 2: Bowhead whale cow-calf areas

Migration

Bowhead whale spring and fall migratory corridors (Figures 3 and 4) were plotted from data collected during the ASAMM project, and its precursors, BWASP and COMIDA, from 1982-2011; data from 1979-1981 were included for the spring migration route. These data were augmented by bowhead whale migratory data obtained via an extensive satellite tagging project conducted by the Alaska Department of Fish and Game (and others) and by acoustic data from recorders placed across the Alaskan Beaufort and northeastern Chukchi seas. The migration is through the lead system that occurs nearshore in the Chukchi Sea and offshore in the Alaskan Beaufort Sea. References: Moore, 1992; Mate et al., 2000; Quakenbush et al., 2010a, 2010b; Clarke et al., 2011b.

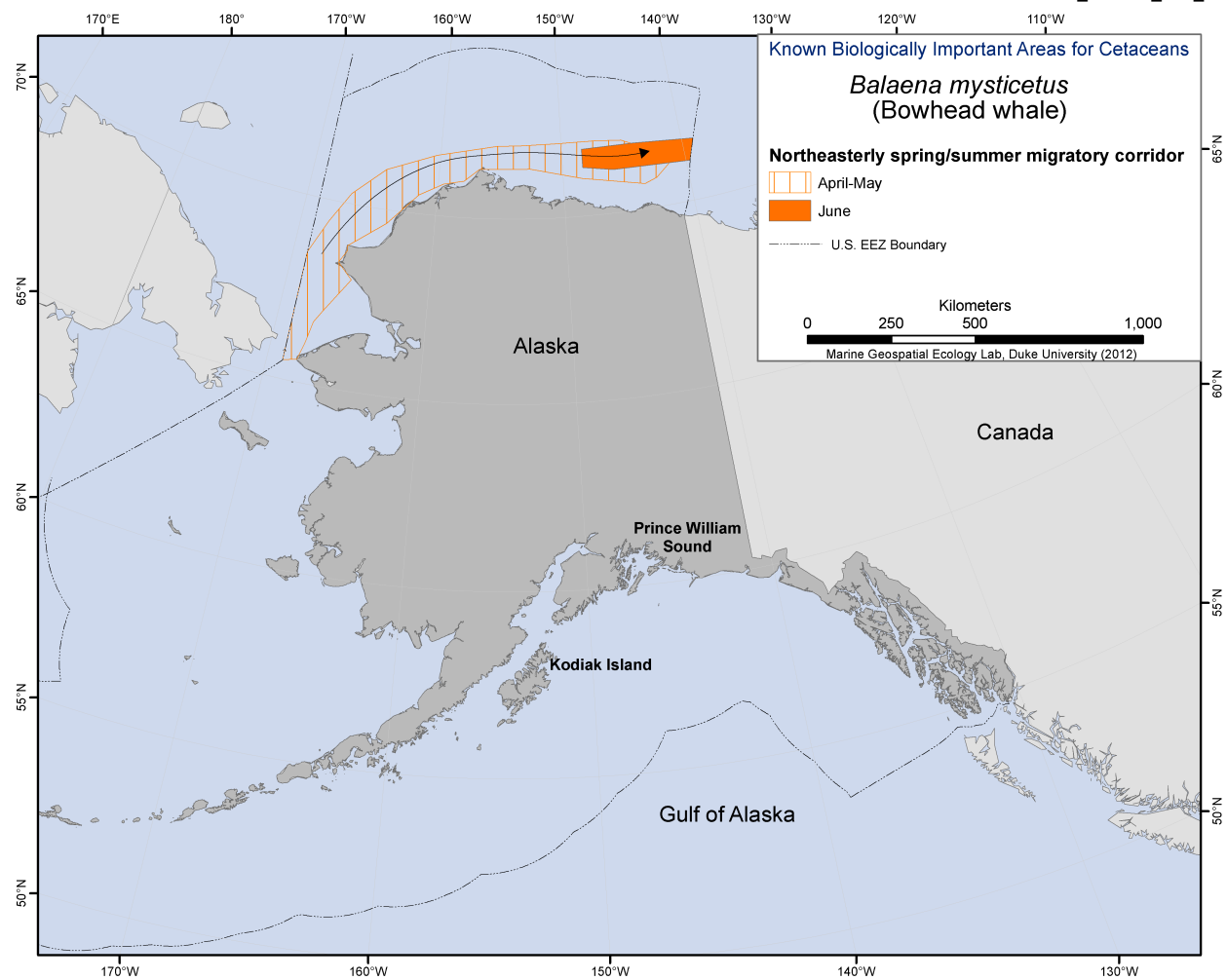


Figure 3: Bowhead whale spring and summer migratory corridors

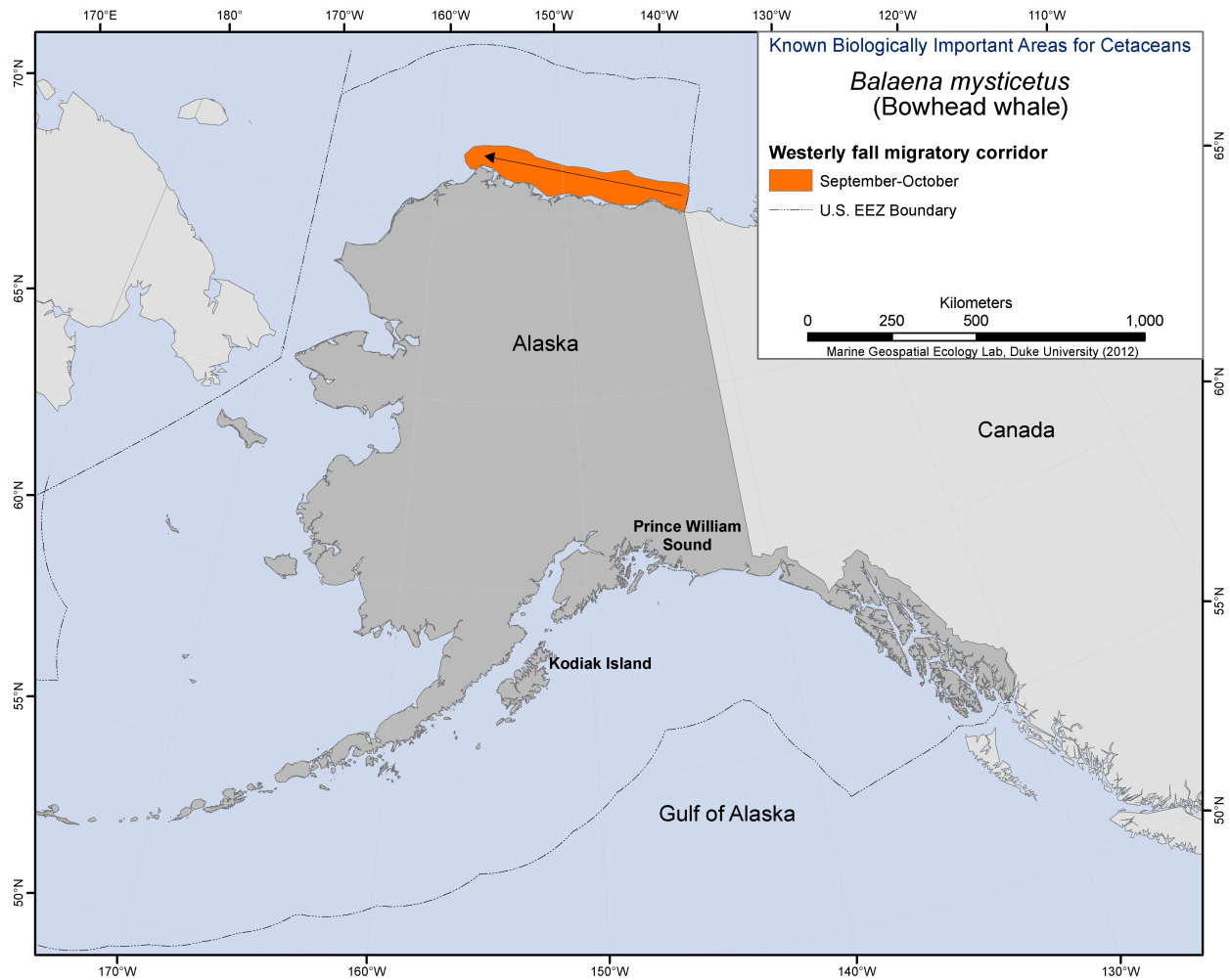


Figure 4: Bowhead whale fall migratory corridor

Bowhead whales migrate primarily on the continental shelf at depths <50 m in fall. Bowhead whales do not venture inside barrier islands or into shallow bays, so Important Areas for bowhead whales along all coasts do not extend inside barrier islands or bays, unless specifically noted. The Important Areas were intentionally drawn to not include parts of Dease Inlet and Smith Bay (east of Barrow but not identified on the map), Harrison Bay and Camden Bay because bowhead whales have not been in those areas either.

References

Clarke, JT and MC Ferguson. 2010a. Aerial surveys for bowhead whales in the Alaskan Beaufort Sea: BWASP Update 2000-2009 with Comparisons to Historical Data. IWC Paper SC/62/BRG14.

Clarke, JT and MC Ferguson. 2010b. Aerial surveys of large whales in the northeastern Chukchi Sea, 2008-2009, with review of 1982-91 Data. IWC Paper SC/62/BRG13.

Clarke, JT, CL Christman, AA Brower, MC Ferguson and SL Grassia. 2011b. Aerial surveys of endangered whales in the Beaufort Sea, fall 2010. Annual Report, OCS Study BOEMRE 2011-035. National Marine Mammal Laboratory, AFSC, NMFS. Available from:
http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BWASP.php.

Clarke, JT, MC Ferguson, CL Christman, SL Grassia, AA Brower and LJ Morse. 2011a. Chukchi offshore monitoring in drilling area (COMIDA) distribution and relative abundance of marine mammals: aerial surveys. Final Report, OCA Study BOEMRE 2011-06. National Marine Mammal Laboratory, AFSC, NMFS. Available from: http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_COMIDA.php.

Clarke, JT, SE Moore and DK Ljungblad. 1987. Observations of bowhead whale (*Balaena mysticetus*) calves in the Alaskan Beaufort Sea during the autumn migration, 1982-85. *Rep. Int. Whaling Commission* 37: 287-293.

Goetz, KT, DJ Rugh and JA Mocklin. 2008. Aerial surveys of bowhead whales in the vicinity of Barrow, Alaska, August-September 2007. In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2007 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC, NMFS for the Minerals Management Service. Available from:
http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Goetz, K, D Rugh and J Mocklin. 2009. Aerial surveys of bowhead whales in the vicinity of Barrow, Alaska, August-September 2008. Section 1 In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2008 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC, NMFS for the Minerals Management Service. Available from:
http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Goetz, K, D Rugh and J Mocklin. 2010. Aerial surveys of bowhead whales in the vicinity of Barrow August-September 2009. Section 1 In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2009 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC, NMFS for the Minerals Management Service. Available from:
http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Goetz, K, D Rugh, L Vate Brattstrom and J Mocklin. 2011. Aerial surveys of bowhead whales near Barrow in late summer 2010. Section 1 In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2010 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC, NMFS for Bureau of Ocean Energy Management, Regulation and Enforcement. Available from:
http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Heide-Jorgensen, MP, KL Laidre, LT Quakenbush and JJ Citta. 2011. The Northwest Passage opens for bowhead whales. *Biology Letters* doi: 10.1098/rsbl.2011.0731

Landino, SW, SD Treacy, SA Zerwick and JB Dunlap. 1994. A large aggregation of bowhead whales (*Balaena mysticetus*) feeding near Point Barrow, Alaska, in late October 1992. *Arctic* 47(3): 232-235.

Mate, BR, GK Krutzikowsky and MH Winsor. 2000. Satellite-monitored movements of radio-tagged bowhead whales in the Beaufort and Chukchi seas during the late-summer feeding season and fall migration. *Canadian Journal of Zoology* 78: 1168-1181.

Mocklin, JA. 2009. Evidence of bowhead whale feeding behavior from aerial photography. AFSC Processed Rep. 2009-006, 118 p. Alaska Fisheries Science Center, NOAA, NMFS, Seattle, WA.

Mocklin, J., C. George, M. Ferguson, L. Vate Brattström, V. Beaver, B. Rone, C. Christman, A. Brower, B. Shea, and C. Accardo. 2012. Aerial photography of bowhead whales near Barrow, Alaska, during the 2011 spring migration. Paper SC/64/BRG3 presented to the IWC Scientific Committee, June 2012 (unpublished). 9pp

Moore, SE. 1992. Summer records of bowhead whales in the northeastern Chukchi Sea. *Arctic* 45(4): 398-400.

Moore, SE, JC George, G Sheffield, J Bacon and CJ Ashjian. 2010. Bowhead whale distribution and feeding near Barrow, Alaska, in late summer 2005-06. *Arctic* 63(2): 195-205.

Quakenbush, LT, JJ Citta, JC George, RJ Small and MP Heide-Jorgensen. 2010a. Fall and winter movements of bowhead whales (*Balaena mysticetus*) in the Chukchi Sea and within a potential petroleum development area. *Arctic* 63(3): 289-307.

Quakenbush, LT, RJ Small and JJ Citta. 2010b. Satellite tracking of western Arctic bowhead whales. Study prepared by the Alaska Department of Fish and Game for the Bureau of Ocean Energy Management, Regulation and Enforcement. OCS Study BOERME 2010-033.

Richardson, WJ and DH Thomson (eds). 2002. Bowhead whale feeding in the eastern Alaskan Beaufort Sea: update of scientific and traditional information. Report prepared by LGL Ltd., King City, Ontario. OCS Study MMS 2002-012. Available from: www.boem.gov.

Zeh, JE, CW Clark, JC George, D Withrow, GM Carroll and WR Koski. 1993. Current Population Size and Dynamics. Chapter 11 In: The Bowhead Whale, Burns, JJ, JJ Montague and CJ Cowles (eds). Special Publication No. 2, The Society for Marine Mammalogy, Lawrence, Kansas.

Metadata

Area Type (see choices below)		Feeding
Migration Direction (if applicable)		N/A
Months of year designation is applicable		May, June-July, September-October
Satellite Tagging data supporting designation (y/n)		no
	# of tags	
	# years in which supporting tagging data collected	
	Nature of supporting information (see description below)	
Visual Observations/Records supporting designation (y/n)		yes
	# observations/records	487 aerial survey records in fall (ASAMM 1982-2011); 543 aerial survey records in late summer (BOWFEST); >900 photo records in May (1985, 1986, 2003, 2004)
	# years in which supporting visual data collected	30 years
	Nature of supporting information	Aerial survey visual observations of muddy animals, echelon feeding formation, open mouths at surface, archived aerial photos of whales with muddy rostrums
Acoustic Detections/Records supporting designation (y/n)		no
	# detections/records	
	# years in which supporting acoustic data collected	
	Nature of supporting information	
Photo-ID evidence supporting designation (y/n)		no
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		no
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Locations of sightings and photos
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bwasp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		Unknown
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		The principal feeding area for this stock (Bering-Chukchi-Beaufort) is in the Canadian Beaufort Sea (Mackenzie River Delta); feeding on lower density prey patches occurs in Beaufort, Chukchi and possibly Bering seas.

Metadata

Area Type (see choices below)		Cow-calf
Migration Direction (if applicable)		NA
Months of year designation is applicable		May, August-October
Satellite Tagging data supporting designation (y/n)		No
	# of tags	
	# years in which supporting tagging data collected	
	Nature of supporting information (see description below)	
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	255 aerial survey records (August to October); 35 aerial survey records (May)
	# years in which supporting visual data collected	30 (1982-2011)
	Nature of supporting information	Aerial survey visual observations and aerial photos of cow-calf pairs
Acoustic Detections/Records supporting designation (y/n)		No
	# detections/records	
	# years in which supporting acoustic data collected	
	Nature of supporting information	
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Locations of sightings and photos
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bwasp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		Unknown
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		Calving occurs during primarily the spring migration, April-June, and may occur in the Bering, Chukchi or Beaufort seas

Metadata

Area Type (see choices below)		Migratory Corridor
Migration Direction (if applicable)		North - Northeast - East
Months of year designation is applicable		April - June
Satellite Tagging data supporting designation (y/n)		Yes
	# of tags	Seven
	# years in which supporting tagging data collected	One (2009)
	Nature of supporting information (see description below)	Satellite tag tracks from Bering Sea through Chukchi Sea into Alaskan Beaufort Sea
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	>1200 aerial survey records; unknown # of ice-based records since late 1970s
	# years in which supporting visual data collected	>30 (aerial surveys plus ice-based census)
	Nature of supporting information	Visual observations from aircraft and ice-based stations
Acoustic Detections/Records supporting designation (y/n)		Yes
	# detections/records	206 detection days at several overwintered recorders (JMP)
	# years in which supporting acoustic data collected	One year for acoustic recorders placed offshore
	Nature of supporting information	Bowhead whale call detections
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Visual observations, acoustic data and tracks of satellite tagged whales
Dataset Sources		
Approximate % of population that uses this area for the designated purpose (if known)		Unknown
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		One documented spring migration path for this stock of bowhead whales, as described above

Metadata

Area Type (see choices below)		Migratory Corridor
Migration Direction (if applicable)		West
Months of year designation is applicable		September-October
Satellite Tagging data supporting designation (y/n)		Yes
	# of tags	Two
	# years in which supporting tagging data collected	Two (2006 and 2008)
	Nature of supporting information (see description below)	Satellite tag tracks from Canadian Beaufort Sea into Alaskan Beaufort Sea
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	>4200 aerial survey records (ASAMM, 1982-2011)
	# years in which supporting visual data collected	30
	Nature of supporting information	Aerial survey visual observations
Acoustic Detections/Records supporting designation (y/n)		Yes
	# detections/records	>130,000 calls from one array of 10 recorders
	# years in which supporting acoustic data collected	Four (2001-2004)
	Nature of supporting information	Bowhead whale calls
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Visual observations, acoustic data and tracks of satellite tagged whales
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bwasp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		Unknown
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		One, as described above

***Delphinapterus leucas* (Beluga)**

Important Area(s) identified: feeding, cow-calf, migratory corridor

General

Two populations of belugas summer in the northeastern Chukchi and Alaskan Beaufort seas, the Beaufort Sea (BS) stock and the Eastern Chukchi Sea (ECS) stock.

Feeding and Reproduction

Belugas in the ECS stock congregate in summer (June and July) immediately offshore of and within Kasegaluk Lagoon, between Point Lay and Icy Cape, Alaska, to feed, molt and calve (Figure 5). Belugas in the Beaufort Sea stock congregate in summer east of the U.S. EEZ, in the Mackenzie River Estuary, Yukon Territory, in early summer, also to feed, molt and calve. These known aggregation areas have provided valuable opportunities for researchers to conduct satellite tagging efforts to determine how and where the whales disperse in late summer and fall. References: Frost et al., 1993; DFO, 2000; Richard et al., 2001; Suydam et al., 2001, 2005.

Migration

April-May – The beluga migratory corridor in spring is similar to that of bowhead whales, in that belugas take advantage of nearshore leads in the ice (Figure 5). Acoustic data from overwintered recorders in the northeastern Chukchi Sea indicate that belugas also migrate somewhat further offshore than the prevailing nearshore lead system. Most belugas sighted during this time period are heading northeast in the Chukchi Sea and east in the Alaskan Beaufort Sea, so these early migrants might be the BS stock. References: Ljungblad et al., 1985; Delarue et al., 2011; Mocklin et al., 2012.

September-October – Sightings from Aerial Surveys of Arctic Marine Mammals (ASAMM) surveys in the Alaskan Beaufort Sea in September and October are primarily on the slope, with relatively few sightings on the shelf (Figure 5). Most belugas are heading west-northwest in the Beaufort Sea, veering southwest near Barrow Canyon (north and west of Pt. Barrow). Data from satellite-tagged belugas from the ECS and BS stocks indicate that belugas venture much farther north than aerial surveys or acoustic recorders can possibly monitor (including well north of the U.S. EEZ), and stocks overlap. Tagging data also indicate that large males tend to migrate farther north than females, but some males remain over the slope as well. References: Ljungblad et al., 1985; Moore, 2000; Moore et al., 2000; Richard et al., 2001; Suydam et al., 2001, 2005; Clarke et al., 2011; Clarke et al., 2012; North Slope Borough, unpublished data.

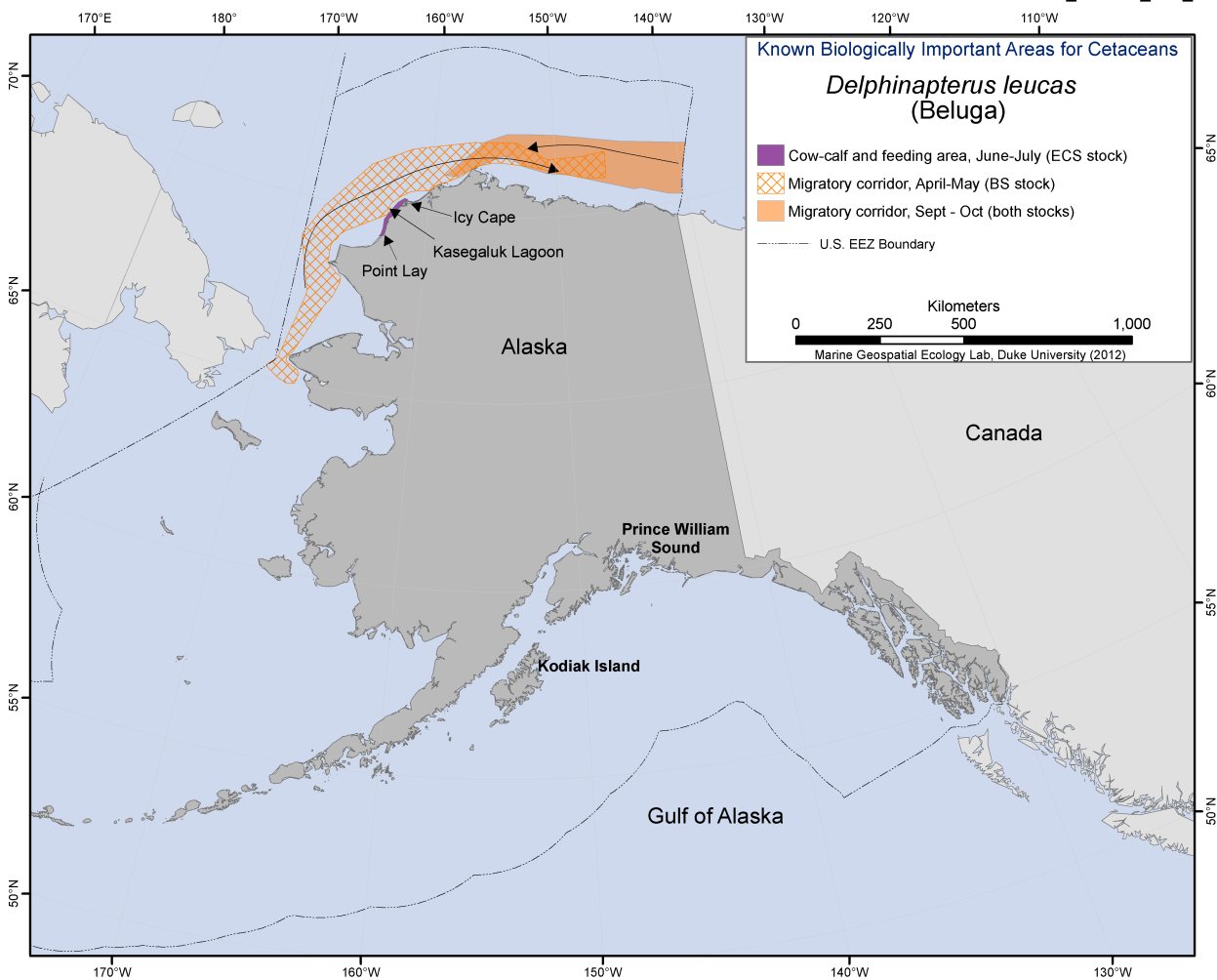


Figure 5: Beluga feeding, calving and migratory corridor areas

References

Clarke, JT, CL Christman, AA Brower, and MC Ferguson. 2012. Distribution and relative abundance of marine mammals in the Alaskan Chukchi and Beaufort Seas, 2011. Annual Report, OCS Study BOEM 2012-009. National Marine Mammal Laboratory, AFSC, NMFS. Available from: http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BWASP.php

Clarke, JT, MC Ferguson, CL Christman, SL Grassia, AA Brower and LJ Morse. 2011. Chukchi offshore monitoring in drilling area (COMIDA) distribution and relative abundance of marine mammals: aerial surveys. Final Report, OCA Study BOEMRE 2011-06. National Marine Mammal Laboratory, AFSC, NMFS. Available from: http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_COMIDA.php.

Department of Fisheries and Oceans. 2000. Eastern Beaufort Sea Beluga Whales. Stock Status Report E5-38.

Delarue, J, B Martin, X Mouy, J MacDonnell, D Hannay, NE Chorney, and J Vallarta. 2011. Chukchi Sea joint acoustic monitoring program. Chapter 5 In: Funk, DW, CM Reiser, DS Ireland, R Rodrigues, and WR Koski (eds.). 2011. Joint Monitoring Program in the Chukchi and Beaufort seas, 2006–2010. LGL Alaska Draft Report P1213-1, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greeneridge Sciences, Inc., and JASCO Research, Ltd., for Shell Offshore, Inc. and Other Industry Contributors, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 592 p. plus Appendices.

Frost, KJ, LF Lowry and G Carroll. 1993. Beluga whale and spotted seal use of a coastal lagoon system in the northeastern Chukchi Sea. *Arctic* 46(1) 8-16.

Ljungblad, DK, SE Moore, JT Clarke, DR Van Schoik and JC Bennett. 1985. Aerial surveys of endangered whales in the northern Bering, eastern Chukchi, and Alaskan Beaufort seas, 1984: with a six-year review, 1979-84. NOSC Technical Report 1046.

Mocklin, J., C. George, M. Ferguson, L. Vate Brattström, V. Beaver, B. Rone, C. Christman, A. Brower, B. Shea, and C. Accardo. 2012. Aerial photography of bowhead whales near Barrow, Alaska, during the 2011 spring migration. Paper SC/64/BRG3 presented to the IWC Scientific Committee, June 2012 (unpublished). 9pp.

Moore, SE. 2000. Variability of cetacean distribution and habitat selection in the Alaskan arctic, autumn 1982-91. *Arctic* 53(4): 448-460.

Moore, SE, DP DeMaster and PK Dayton. 2000. Cetacean habitat selection in the Alaskan arctic during summer and autumn. *Arctic* 53(4): 432-447.

Richard, PR, AR Martin and JR Orr. 2001. Summer and autumn movements of belugas of the eastern Beaufort Sea stock. *Arctic* 54(3): 223-236.

Suydam, RS, LF Lowry, KJ Frost, GM O'Corry-Crowe and D Pikok, Jr. 2001. Satellite tracking of eastern Chukchi Sea beluga whales in the Arctic Ocean. *Arctic* 54(3): 237-243.

Suydam, R, LF Lowry and KF Frost. 2005. Distribution and Movements of Beluga Whales from the Eastern Chukchi Sea Stock During Summer and Early Autumn. Final Report prepared for U.S. Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region. OCS STUDY MMS 2005-035

Metadata

Area Type (see choices below)		Feeding, Cow-calf
Migration Direction (if applicable)		NA
Months of year designation is applicable		June-July
Satellite Tagging data supporting designation (y/n)		Yes
	# of tags	26
	# years in which supporting tagging data collected	Six (1998-2002, 2007)
	Nature of supporting information (see description below)	Tagging effort took advantage of annual aggregation of belugas in Kasegaluk Lagoon
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	>11,000 belugas during aerial surveys (1990-1991); 101 aerial survey records (2008-2011)
	# years in which supporting visual data collected	Six (1990-91; 2008-2011)
	Nature of supporting information	Aerial survey visual observations
Acoustic Detections/Records supporting designation (y/n)		No
	# detections/records	
	# years in which supporting acoustic data collected	
	Nature of supporting information	
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Visual observations and traditional ecological knowledge
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bwasp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		>90%
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		One, as described above

Metadata

Area Type (see choices below)		Migratory Corridor
Migration Direction (if applicable)		North - Northeast - East
Months of year designation is applicable		April - May
Satellite Tagging data supporting designation (y/n)		No
	# of tags	
	# years in which supporting tagging data collected	
	Nature of supporting information (see description below)	
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	191 aerial survey records (ASAMM: 1982-1984); 665 aerial survey records (NSB-NMFS Spring 2011)
	# years in which supporting visual data collected	4 (ASAMM, 1982-1984; NSB, 2011)
	Nature of supporting information	Aerial survey visual observations of belugas
Acoustic Detections/Records supporting designation (y/n)		Yes
	# detections/records	206 detection days at several overwintered recorders (JMP)
	# years in which supporting acoustic data collected	One year for acoustic recorders placed offshore
	Nature of supporting information	Beluga call detections
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Visual observations and acoustic data
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bwasp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		Unknown, but likely 100%
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		For the Beaufort Sea stock, one, as described above

Metadata

Area Type (see choices below)		Migratory Corridor
Migration Direction (if applicable)		West
Months of year designation is applicable		September-October
Satellite Tagging data supporting designation (y/n)		Yes
	# of tags	>60
	# years in which supporting tagging data collected	11
	Nature of supporting information (see description below)	Satellite tag tracks from belugas tagged in Kasegaluk Lagoon (ECS stock) as well as those tagged in MacKenzie River Delta (BS stock)
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	>2700 aerial survey records (ASAMM, 1982-2011)
	# years in which supporting visual data collected	30
	Nature of supporting information	Aerial survey visual observations
Acoustic Detections/Records supporting designation (y/n)		No
	# detections/records	
	# years in which supporting acoustic data collected	
	Nature of supporting information	
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Visual observations and tracks of satellite tagged whales
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bwasp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		Unknown - belugas migrate much farther north than the area shown
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		Unknown

***Eschrichtius robustus* (Gray Whale)**

Important Area(s) identified: feeding, cow-calf

General

Eastern North Pacific gray whale stock distribution in U.S. EEZ arctic waters extends to the northeastern Chukchi Sea. There is no evidence yet that gray whales from the Western North Pacific stock summer in the Chukchi Sea. While gray whales are very occasionally seen in the Beaufort Sea, their occurrence there is considered extralimital; in the extensive 1979-2011 ASAMM database for the Alaskan Beaufort Sea, there are only three sightings of five gray whales east of 155°W. Cetacean research in the northeastern Chukchi Sea does not have the same long uninterrupted record that exists for the Alaskan Beaufort Sea. Broad scale aerial surveys, sponsored by MMS, were conducted regularly in the 1980s and early 1990s, and started again in 2008; these surveys cover the Alaskan Chukchi Sea from 68° to 72°N. From 1992-2007, marine mammal studies in the Chukchi Sea were limited to localized areas of interest to the oil and gas industry, investigations of oceanographic and benthic systems during which marine mammal sightings were also recorded, and information incidental to other research. Despite the temporal interruption of broad scale surveys, information pertaining to gray whale occurrence and behaviors in the northeastern Chukchi Sea is still fairly comprehensive. The southern Chukchi Sea (south of 68°N) has been surveyed much less extensively; the relative scarcity of effort in this region is why sightings from 1980-1981 within the ASAMM database were included in the gray whale analysis. Due to the overall lack of systematic effort, gray whale occurrence and behavior in many parts of the southern Chukchi Sea are unknown. Absence of Important Areas related to gray whales in the southern Chukchi is perhaps more a reflection of the lack of survey effort rather than the absence of gray whales.

Feeding

Gray whale feeding is identified during aerial surveys by the presence of mud plumes produced as whales surface after feeding on infaunal species. Gray whale feeding Important Areas for summer and fall (Figure 6) were derived primarily from data collected during the Aerial Survey of Arctic Marine Mammals (ASAMM) project (1979-2011), and augmented by information from industry sponsored studies and oceanographic and benthic investigations. Areas included here represent both areas of historical importance to gray whales as well as those areas where feeding gray whales are currently seen. There are three principal areas where feeding gray whales are consistently observed throughout summer (June-October). In the northeastern Chukchi Sea, gray whales are observed feeding between Pt. Barrow and ~Icy Cape, within ~75 km of shore. Gray whales are also seen feeding very nearshore from south of Pt. Hope to east of Cape Lisburne (Ledyard Bay) in most months. Finally, in the southcentral Chukchi Sea, gray whales have been documented feeding offshore from ~66.5° to 68.5°N in most summer months. References: Clarke and Moore, 2002; Moore et al., 2003; Bluhm et al., 2007; Stafford et al., 2007; Goetz et al., 2008, 2009, 2010, 2011; Anonymous, 2010; Clarke and Ferguson, 2010; Clarke et al., 2011.

Reproduction

Gray whale calf occurrence in the Alaskan Chukchi Sea appears to be irregular. In the sixteen years that aerial surveys have been conducted with some regularity (1980-1991, 2008-2011), calves have been seen in only ten of those years. More than one gray whale calf per year has been documented in only five of the sixteen years. Within any one year, calves may be resighted; this is not generally noted in the database and could inflate the number of sightings per year. Despite this, calf distribution patterns can be inferred. Gray whale calf distribution in the northeastern Chukchi Sea overlaps the distribution of the gray whale population in general (Figure 6), with the exception that calves are rarely found offshore (e.g., Hanna Shoal). The nearshore habitat may provide some refuge from potential predators (e.g., killer whales) as has been noted for gray whales elsewhere. Calves were seen from June through September, with the greatest number reported during July (which is also the peak month for gray whale sightings overall). July calves also had the most widespread distribution, extending from slightly east of Pt. Barrow to south of Pt. Hope. No calves were seen in the southern Alaskan Chukchi Sea, although there is also far less aerial survey effort there. References: Moore et al., 1986; Clarke et al., 1989; Clarke et al., 2011.

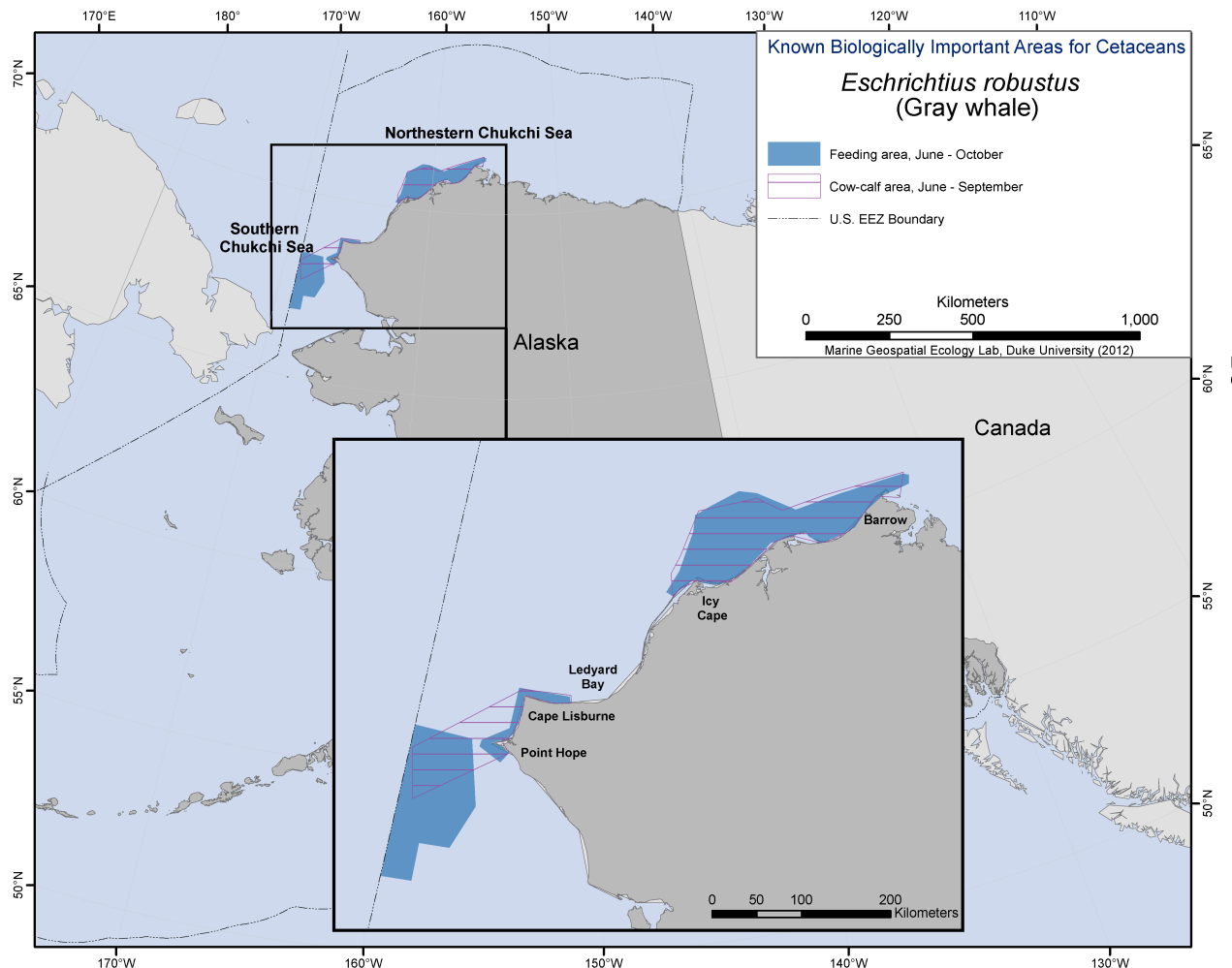


Figure 6: Gray whale feeding and cow-calf areas

References

Anonymous. 2010. Report on the execution of marine research in the Bering Strait, East Siberian and the Chukchi Sea by the Russian-American Expedition under the program of "RUSALCA" during the period from 23 August through 30 September, 2009.

Bluhm, B, KO Coyle, B Konar and R Highsmith. 2007. High gray whale relative abundances associated with an oceanographic front in the south-central Chukchi Sea. *Deep Sea Research Part II: Topical Studies in Oceanography* 54(23-26):2919-2933. 2007. Effects of Climate Variability on Sub-Arctic Marine Ecosystems - A GLOBEC Symposium, GLOBEC-ESSAS Symposium.

Clarke, JT and MC Ferguson. 2010. Aerial surveys of large whales in the northeastern Chukchi Sea, 2008-2009, with review of 1982-91 Data. IWC Paper SC/62/BRG13.

Clarke, JT and SE Moore. 2002. A note on observations of gray whales in the southern Chukchi and northern Bering Seas, August-November, 1980-89. *J. Cetacean Res. Manage.* 4(3): 283-288.

Clarke, JT, MC Ferguson, CL Christman, SL Grassia, AA Brower and LJ Morse. 2011. Chukchi offshore monitoring in drilling area (COMIDA) distribution and relative abundance of marine mammals: aerial surveys. Final Report, OCA Study BOEMRE 2011-06. National Marine Mammal Laboratory, AFSC, NMFS. Available from: http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_COMIDA.php.

Clarke, JT, SE Moore and DK Ljungblad. 1989. Observations on gray whale (*Eschrichtius robustus*) utilization patterns in the northeastern Chukchi Sea, July-October 1982-87. *Canadian Journal of Zoology* 67: 2646-2654.

Goetz, KT, DJ Rugh and JA Mocklin. 2008. Aerial surveys of bowhead whales in the vicinity of Barrow, Alaska, August-September 2007. In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2007 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC, NMFS for the Minerals Management Service. Available from: http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Goetz, K, D Rugh and J Mocklin. 2009. Aerial surveys of bowhead whales in the vicinity of Barrow, Alaska, August-September 2008. Section 1 In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2008 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC, NMFS for the Minerals Management Service. Available from: http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Goetz, K, D Rugh and J Mocklin. 2010. Aerial surveys of bowhead whales in the vicinity of Barrow August-September 2009. Section 1 In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2009 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC, NMFS for the Minerals Management Service. Available from: http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Goetz, K, D Rugh, L Vate Brattstrom and J Mocklin. 2011. Aerial surveys of bowhead whales near Barrow in late summer 2010. Section 1 In: Bowhead whale feeding ecology study (BOWFEST) in the western Beaufort Sea, 2010 Annual Report. Prepared by National Marine Mammal Laboratory, AFSC,

NMFS for Bureau of Ocean Energy Management, Regulation and Enforcement. Available from:

http://www.afsc.noaa.gov/NMML/cetacean/bwasp/flights_BOWFEST.php.

Moore, SE, JM Grebmeier and JR Davies. 2003. Gray whale distribution relative to forage habitat in the northern Bering Sea: current conditions and retrospective summary. *Canadian Journal of Zoology* 81: 734-742.

Moore, SE, DK Ljungblad and DR Van Schoik. 1986. Annual patterns of gray whale (*Eschrichtius robustus*) distribution, abundance and behavior in the northern Bering and eastern Chukchi Seas, July 1980-83. *Rep. Int. Whaling Commission* Special Issue No. 8: 231-242.

Stafford, KM, SE Moore, M Spillane and S Wiggins. 2007. Gray whale calls recorded near Barrow, Alaska, throughout winter of 2003-04. *Arctic* 60(2): 167-172.

Metadata

Area Type (see choices below)		Feeding
Migration Direction (if applicable)		NA
Months of year designation is applicable		June-October
Satellite Tagging data supporting designation (y/n)		No
	# of tags	
	# years in which supporting tagging data collected	
	Nature of supporting information (see description below)	
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	794 aerial survey records (ASAMM - northeast Chukchi); 2584 vessel sighted whales (southern Chukchi); 40 vessel sighting records (RUSALCA)
	# years in which supporting visual data collected	18 years: 1980-1991; 2008-2011 (ASAMM); 2003 (Vessel in southern Chukchi); 2009 (RUSALCA cruise)
	Nature of supporting information	Visual observations from aircraft and vessel of gray whales surfacing with mud streaming from the mouth
Acoustic Detections/Records supporting designation (y/n)		No
	# detections/records	
	# years in which supporting acoustic data collected	
	Nature of supporting information	
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Locations of sightings
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bw.asp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		Unknown
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		Several: southern Chukchi Sea (principal), northern Chukchi (both Chukotkan and Alaskan sides), Kodiak Island, Vancouver Island

Metadata

Area Type (see choices below)		Cow-calf
Migration Direction (if applicable)		NA
Months of year designation is applicable		June-September
Satellite Tagging data supporting designation (y/n)		No
	# of tags	
	# years in which supporting tagging data collected	
	Nature of supporting information (see description below)	
Visual Observations/Records supporting designation (y/n)		Yes
	# observations/records	57 aerial survey recrods
	# years in which supporting visual data collected	16 years: 1980-1991; 2008-2011 (ASAMM)
	Nature of supporting information	Aerial survey visual observations of gray whales with calves
Acoustic Detections/Records supporting designation (y/n)		No
	# detections/records	
	# years in which supporting acoustic data collected	
	Nature of supporting information	
Photo-ID evidence supporting designation (y/n)		No
	# individuals photographed	
	# of years of photo records to compare	
	maximum # years same individual photo'd in area	
	Nature of supporting information	
Genetic Analyses conducted supporting designation (y/n)		No
	weak/moderate/strong support for genetic differentiation	
	Nature of supporting information	
What factors justify the boundary selection?		Locations of Sightings
Dataset Sources		ASAMM: http://www.afsc.noaa.gov/NMML/software/bwasp-comida.php
Approximate % of population that uses this area for the designated purpose (if known)		Unknown
Approximate # of areas known specifically for this behavior (if feeding/cow-calf/mating/migratory) for this population		Unknown